WE CLAIM:

1.   An apparatus for stacking and unstacking a plurality of sample holders comprising

5   a first stacking station designed to hold a plurality of sample holders in a first stack, and

a singulation mechanism capable of automatically adding and subtracting sample holders to and from the first stack.

10   2.   The apparatus of claim 1, wherein the singulation mechanism includes a plurality of latch members that are capable of receiving and releasing a sample holder to and from the first stack.

3.   The apparatus of claim 2, wherein the latch members are also capable of

15   manipulating lids for the sample holders.

4.   The apparatus of claim 1, wherein the sample holders are microplates.

5.   The apparatus of claim 1, wherein the sample holders are biochips.

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6.   The apparatus of claim 1, wherein the singulation mechanism includes at least one lifter and at least one latch, the lifter and latch cooperating to move sample holders in and out of the first stack.

7.   The apparatus of claim 1, wherein the singulation mechanism includes at least one latch and an electromagnet mounted near the latch, wherein the latch is biased into the first stack when the electromagnet is off, and the electromagnet attracts the latch out of the first stack when the electromagnet is on.

8.   The apparatus of claim 6, wherein the latch has a tip and the lifter has a notch, the tip of the latch moving passively into the notch of the lifter after a sample holder has been added to the first stack.

9.   The apparatus of claim 1, wherein the singulation mechanism adds a sample holder to the first stack passively, and releases a sample holder from the first stack by operating an electromagnetic switch.

10.   The apparatus of claim 1, wherein the singulation mechanism adds and removes sample holders to and from the bottom of the first stack.

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12.   The apparatus of claim 11, wherein the first stack has a substantially vertical stacking direction, the transport device moving sample holders in a direction substantially perpendicular to the stacking direction.

13.   The apparatus of claim 1 further comprising a second stacking station, the first and second stacking stations being served by a single transport device so that a sample holder can be transported from one stacking station to the other stacking station.

14.   The apparatus of claim 13, wherein each of the first and second stacking stations includes a singulation mechanism capable of adding and subtracting sample holders to and from a stack of sample holders contained in the stacking station.

15.   The apparatus of claim 11 further comprising

a fluid dispensing station configured to dispense fluid to sites in a sample holder.

16.   The device of claim 15, wherein the fluid dispensing station includes an array of noncontact dispensing tips capable of delivering aliquots to wells in a microplate, wherein aliquots can be delivered in a range of volumes including volumes of less than about 5 microliters.

6. The apparatus of claim 1, wherein the singulation mechanism includes at least one lifter and at least one latch, the lifter and latch cooperating to move sample holders in and out of the first stack.

5   7. The apparatus of claim 1, wherein the singulation mechanism includes at least one latch and an electromagnet mounted near the latch, wherein the latch is biased into the first stack when the electromagnet is off, and the electromagnet attracts the latch out of the first stack when the electromagnet is on.

8. The apparatus of claim 6, wherein the latch has a tip and the lifter has a notch, the tip of the latch moving passively into the notch of the lifter after a sample holder has been added to the first stack.

9. The apparatus of claim 1, wherein the singulation mechanism adds a sample holder to the first stack passively, and releases a sample holder from the first stack by operating an electromagnetic switch.

10. The apparatus of claim 1, wherein the singulation mechanism adds and removes sample holders to and from the bottom of the first stack.

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11. The apparatus of claim 10 further comprising a transport device that moves a sample holder to and from the first stack.

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17. An apparatus for processing assays comprising

first and second stacking stations, each stacking station configured to hold a stack of microplates, wherein at least one of the stacking stations has a bidirectional capability to release and receive microplates from and to the bottom of the stack,

a fluid dispensing station having an array of dispense tips for depositing fluid aliquots into wells of a microplate, and

a microplate shuttle device that carries microplates between stations.

18. The apparatus of claim 17 further comprising

an analyzer station also served by the shuttle device so that microplates can be automatically carried between any one of the stations and the analyzer.

19. The apparatus of claim 18 further comprising

a controller that schedules and initiates singulation of microplates to and from stacking stations, transport of microplates between stations, dispensing of fluid into microplates at the fluid dispensing station, and analysis of samples at the analyzer station.

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20.   An integrated apparatus for processing a plurality of sample holders comprising

an analyzer having an examination site,

an input site for receiving a sample holder,

5   a shuttle device for carrying a sample holder in two directions along a processing path between the input site and the examination site, and

at least one stacking unit along the processing path including a singulation mechanism capable of receiving and releasing microplates from and to the processing path.

21.   The apparatus of claim 20 further comprising

a second stacking unit along the processing path.

22.   The apparatus of claim 20 further comprising

a fluid dispensing unit along the processing path.